

NASA’S Space Launch System: Progress Toward the Proving Ground

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Abstract

With significant and substantial progress being accomplished toward readying the Space Launch System (SLS) rocket for its first test flight, work is already also underway on preparations for the second flight – using an upgraded version of the vehicle – and beyond. Designed to support human missions into deep space, Space Launch System (SLS), is the most powerful human-rated launch vehicle the United States has ever undertaken, and together with the Orion spacecraft will support human exploration missions into the proving ground of cislunar space and ultimately to Mars. For its first flight, SLS will deliver a near-term heavy-lift capability for the nation with its 70-metric-ton (t) Block 1 configuration. Each element of the vehicle now has flight hardware in production in support of the initial flight of the SLS, which will propel Orion around the moon and back. For its second flight, SLS will be upgraded to the more-capable Block 1B configuration. While the Block 1 configuration is capable of delivering more than 70 metric tons to low Earth orbit, the Block 1B vehicle will increase that capability to 105 t. For that flight, the new configuration introduces two major new elements to the vehicle – an Exploration Upper Stage (EUS) that will be used for both ascent and in-space propulsion, and a Universal Stage Adapter (USA) that serves as a “payload bay” for the rocket, allowing the launch of large exploration systems along with the Orion spacecraft. Already, flight hardware is being prepared for the Block 1B vehicle. Beyond the second flight, additional upgrades will be made to the vehicle. The Block 1B vehicle will also be able to launch 8.4-meter-diameter payload fairings, larger than any previously flown, and the SPIE Element will oversee development and production of those fairings. Ultimately, SLS will be evolved to a Block 2 configuration, which will replace the solid rocket boosters on the Block 1 and 1B vehicles with more powerful boosters, and will be capable of delivering at least 130 metric tons to LEO. The Block 2 vehicle will be capable of launching even larger 10-meter diameter fairings, which will enable human mission of Mars. With these fairings, the Block 1B and 2 configurations of SLS will also be enabling for a wide variety of other payloads. For robotic science probes to the outer solar system, for example, SLS can cut transit times to less than half that of currently available vehicles, producing earlier data return, enhancing iterative exploration, and reducing mission cost and risk. In the field of astrophysics, SLS’ high payload volume, in the form of payload fairings with a diameter of up to 10 meters, creates the opportunity for launch of large-aperture telescopes providing an unprecedented look at our universe, and offers the ability to conduct crewed servicing missions to observatories stationed at locations beyond low Earth orbit. This paper will provide a description of the SLS vehicle, and an overview of the vehicle’s capabilities and utilization potential.